

- Lateral spines of abdominal segments 8 and 9 more nearly the same length. Those of segment 9 less in length than the margin of segment 9..... (32)
- 32—Distribution Northern: Me., Wisc.; Hudson's Bay to B. C. and Alaska ..... (33)
- Distribution Southern: Tropics and Gulf Strip; S. E. States, Tex.; W. Ind.; Mex. to Argentine. *Erythrodiplax*  
"Micrathyria"
- 33—Prominent bunches of setae present on the dorsum of abdominal segments 4-9 ..... *Erythrodiplax*  
No such arrangement of setae on the abdomen.  
*Leucorrhinia*
- Unknown Genera: [*Platycordulia*, *Williamsonia*, *Pseudolcon*, *Uracis*, *Macrodiplax*, *Tauriphila*, *Ephidatia*, *Brechmorhoga*].

### A Summary of Insects Attracted to Liquid Baits.<sup>1</sup>

By S. W. FROST, The Pennsylvania State College.

During 1933 and 1934, seventy-five attractants were used to attract oriental fruit moths in a peach orchard interplanted with apple trees in Adams County, Pennsylvania. Each experiment consisted of ten traps. The tests were repeated four times during the summer, covering a period of twenty-one weeks, except in a few cases where materials were not attractive. A mixture of one part refiner's syrup and twenty parts water was placed in all traps, with chemicals added at the rate of one cubic centimeter, or one gram, per trap. Most of the acids were soluble in the baits. Cinnamic, camphoric and picric acids and borneol were dissolved in alcohol before adding them to the mixture. Methyl cinnamate, piperonal and thymol were dissolved in warm mineral oil and then emulsified. These and all other chemicals were emulsified with 3 grams of number 235 American Cyanamid spreader, 30 cc. of water and 10 grams or 10 cc. of the attractant. This made sufficient bait for ten traps. A record was kept of insects that visited the baits. Since reports have been published on many of these, the present paper is concerned primarily with miscellaneous insects

<sup>1</sup> Publication authorized by the Director of The Pennsylvania Agricultural Experiment Station, November 6, 1934, as Technical Paper No. 664.

which have been taken in relatively large numbers, and may prove of value to other workers.

#### DIPTERA.

Tabanidae were captured in relatively large numbers. About seventy-five percent of the catches were females. This was rather surprising as the females are largely blood feeders. Seven species of *Tabanus* were taken: *T. lasiophthalmus* Macq., during May and June; *T. atratus* Fab., from June 11 to September, 13; *T. sulcifrons* Macq., during July and August; *T. giganteus* De Geer, chiefly during late September and early October; and occasional specimens of *T. nigrescens* P. B., *T. lincola* Fab. and *T. costalis* Wied. A few incidental captures of *Chrysops* were made. Dr. J. S. Hine checked the identification of these species for the writer. Soap, sodium oleate, camphoric and oleic acids were outstanding attractants.

Reports on Ortalidae have been published heretofore.<sup>2</sup> During 1933, notes were taken on three species: *Euresta notata*; *Pseudotephritis vau*; and *Callopistromyia annulipes*. These are grouped in the following table. Sweet baits, such as amyl acetate and syrup, were most attractive. Acids were generally unattractive, although citric and malic acids caught comparatively large numbers.

Judging from the comparatively small numbers taken in traps, Syrphidae are not attracted but are probably chance catches. On the other hand, a remarkable number of species were taken. These include *Volucella vesiculosa* Fab., *Ferdinandeia diva* O. S., *Syrphus ribesii* Linn., *Mesogramma marginata* Say., *M. polita* Say, *Tenthredomyia abbreviata* Loew, *Spilomyia hamifera* Loew, *Criorhina decora* Macq., *Ceriodia willistonii* Kohl, *C. signifera* Loew, *Chrysogaster nitida* Wied., *Sphacrophora cylindrica* Say, *Platychirus erraticus* Curran, *Milesia virginienensis* Drury, *Mallota posticata* Fab., *Syrpitta pipicus* L., and *Didea fasciata* Macq. The above determinations were made by Mr. R. C. Shannon and Mr. C. G. Green through the cour-

<sup>2</sup> Notes on Ortalidae. ENT. NEWS 30, No. 6: 169-172, 1928. Notes on Pennsylvania Ortalidae. ENT. NEWS 40: 84-87, 1929.

tesy of the late Dr. J. M. Aldrich of the United States National Museum. *Ferdinandea dives* and *Syrphus ribesii* were the common captures during May, while *Volucella vesiculosa* and *Mesogramma marginata* were the common species taken during June, July and August. They show a preference, if any, for the sweet baits.

At least a dozen species of Stratiomyidae were taken in baits. These have not been determined but are preserved for future study.

*Bibio femoratus* Wied. came to baits in large numbers from May 2 to June 16, 1933; 513 specimens were captured. There seemed to be little difference in the attractiveness of the various baits. Baffles increased the catches considerably.

Twelve specimens of the rare *Onocodes incultus* O. S., were taken from one set of traps on June 15.

Other Diptera were taken in large numbers. *Anisopus* was exceedingly abundant, especially during April, although specimens were taken in May, June and July. Drosophilidae, Muscidae, Tabanidae and Anthomyiidae were attracted in liberal numbers.

#### LEPIDOPTERA.

During 1934, an attempt was made to skim certain moths, other than the oriental fruit moth, from the surface of the baits. The codling moth, *Carpocapsa pomonella* Clem., the bud-moths, *Sparganothis idaeusalis* Walk. and *Spilonota ocellana* D. & S., and the leaf-rollers, *Eulia velutinana* Walk., *Archips argyrospila* Walk., and *A. rosaceana* Harris, were taken in comparatively small numbers. These insects were probably not abundant in the twelve-year-old orchard where the work was conducted, but it is suspected that bud-moths and leaf-rollers might respond freely to some baits.

The peach borer is not readily attracted to baits, and as a rule, only the males respond to the stimulus. Adults were trapped earlier in the season than previous records indicate that they fly. One male was captured the week of May 24 to 31. Four specimens were taken during the week of May 31 to June 6. It is possible that a bait may be discovered that will be useful in determining the flight periods of this moth.

*Synanthedon scitula* Harris, the larva of which feeds in the galls of various trees, was taken in rather striking numbers during June. A few were captured earlier than this, and some during July, but none after August 8. Sweet baits were most attractive. Acids, with the exception of citric, malic, tartaric and succinic, were unattractive.

Noctuidae rank next in numbers to the oriental fruit moth, and are generally attracted by the same type of baits. There is at least one exception. Terpinyl acetate is highly attractive to the oriental fruit moth but not strongly attractive to the Noctuidae.

Although many other moths were captured it was difficult to make determinations because the bait destroyed essential characters. *Eustrotia carncola* Guenee, however, was a conspicuous visitor.

#### HYMENOPTERA.

Parasitic insects are a minor factor in the operation of baits and have never been taken in appreciable numbers. During 1933, only thirty specimens of *Glypta rufiscutellaris* and *Macrocentrus ancyliwora* were captured in 400 traps operating over a period of twenty-one weeks. Other parasitic forms were rare visitors.

Honey bees are not strongly attracted to syrup or aromatic baits. Citral and anethol were the only materials that attracted a noticeable number.

Several species of Vespidae were taken in baits but were apparently not attracted. The species taken were *V. diabolica* Sauss, *V. maculata* L., *V. crabro* L., and *V. maculifrons* Buy.

*Polistes pallipes* Lep. was captured in moderate numbers chiefly in late June and early July.

Other Hymenoptera were captured but the magnitude of the problem prohibited accurate records. Ants, of course, were taken in great numbers. Tenthredinidae were frequent visitors. Mutillidae, Chrysididae, Ichneumonidae and Chalcididae were taken rarely. *Monobia quadridens* and *Sphecius speciosus* were seen quite frequently in baits.

## COLEOPTERA.

*Glischrochilus fasciatus* (Oliv.), a natural sap-feeder, was taken in moderate to large numbers from April 25 to September 25, but the catches were noticeably reduced during August and September. It was attracted by sweet baits, particularly syrup and water. The addition of soap and sodium oleate increased the catches. Amyl acetate and anethol were especially alluring. Acids, on the whole, were not attractive, although tartaric, acetic and formic acids caught many of these beetles. Cinnamic acid was decidedly repulsive.

Elateridae, chiefly species of *Melanotus*, were captured largely during June. Although 158 specimens were taken during 1934, it is probable that they were attracted not by the baits but, having the habits of visiting peach and apple, accidentally tumbled into the traps.

Cerambycidae came to the traps freely, especially when they were placed in or near wooded areas. During 1933 and 1934 the traps were not located near woodlands and the catches were comparatively small. The addition of sodium arsenite to the syrup seemed to increase the catches considerably.

*Euphoria inda*, as might be expected, was taken chiefly in June, although some were captured in July, August and September. Sweet baits, amyl acetate and plain syrup, were most attractive. Acids were decidedly unattractive.

*Lachnosternae* were numerous when traps are placed in the vicinity of wooded areas. The traps used were placed in a peach orchard, and only 215 specimens were taken during 1933.

The plum curculio, *Conotrachelus nenuphar* (Hbst.), is not attracted to baits, but occasionally falls in the traps when the trees are jarred.

Other Coleoptera have been taken in great abundance and data are reported in a previous paper.<sup>3</sup>

(To be continued)

<sup>3</sup> Coleoptera taken from Bait Traps. Ann. Amer. Ent. Soc. 22: 427-437, 1929.